

CLAIMS

What is claimed is:

1. A method, comprising:

selecting a target patch to be filled in an image;

selecting a sample patch as a candidate for filling the target patch;

determining a first difference between a first area surrounding the target patch and a corresponding first area surrounding the sample patch, and a second difference between a second area surrounding the target patch and a corresponding second area surrounding the sample patch;

multiplying a larger of the first difference and the second difference with a first weight factor, and a smaller of the first difference and the second difference with a second weight factor; and

summing the weighted first difference and the weighted second difference as a distance between the target patch and the sample patch.

2. The method of claim 1, wherein the sample patch is selected from the image.

3. The method of claim 1, wherein said determining a first difference and said determining a second difference comprise:

$$d_n = \left[\frac{1}{A_n} \sum_{i=1}^{A_n} (p_{B_i}^i - p_{B(x,y)}^i)^2 \right]^{1/2},$$

where d_n is the difference of an n th pair of corresponding areas, A_n is the number of corresponding points in the n th pair of corresponding areas, and $p_{B_k}^i$ and $p_{B(x,y)}^i$ are the corresponding gray values of the corresponding points in the target patch and the sample patch, respectively.

4. The method of claim 3, wherein said multiplying and said summing comprise:

$$d = \sum_{i=1}^n \alpha_i d_i ,$$

$$\alpha_i = \frac{1}{\text{sequence}(d_i)} ,$$

where d is the distance between the target patch and the sample patch, d_i is the difference of the i th pair of corresponding boundary areas in a descending sequence, α_i is the weight given to the difference d_i , and n is the total number of corresponding boundary areas.

5. The method of claim 1, further comprising:

adjusting pixel values of the sample patch to match the first and the second areas surrounding the target patch; and

filling the target patch with the adjusted sample patch.

6. The method of claim 5, wherein said adjusting values of the sample patch comprises determining an adjusted sample patch that minimizes the following equation:

$$J(u) = \int_{\Omega} \left(\frac{\partial u}{\partial x} - \frac{\partial g}{\partial x} \right)^2 + \left(\frac{\partial u}{\partial y} - \frac{\partial g}{\partial y} \right)^2 d(x, y) + \lambda \int_{\Omega} (u - f)^2 d(x, y) ,$$

where u is the adjusted sample patch, g is the sample patch, f includes the first and the second areas, Ω is an area to be filled with the adjusted sample patch u , $\frac{\partial u}{\partial x}$ is a gradient of the adjusted sample patch u in x direction at point (x, y) , $\frac{\partial u}{\partial y}$ is a gradient of the adjusted sample patch u in y direction at point (x, y) , $\frac{\partial g}{\partial x}$ is a gradient of the sample patch g in x direction at point (x, y) , and $\frac{\partial g}{\partial y}$ is a gradient of the sample patch image g in y direction at point (x, y) , and λ is a weight factor.

7. The method of claim 1, further comprising:

rotating the sample patch along with the first and the second areas;

determining another first difference between the first area surrounding the target patch and another corresponding first area surrounding the sample patch after said rotating, and another second difference between the second area surrounding the target patch and another corresponding second area surrounding the sample patch after said rotating;

multiplying the larger of said another first difference and said another second difference with the first weight factor, and the smaller of said another first difference and said another second difference with the second weight factor;

summing the weighted another first difference and the weighted another second difference as another distance between the target patch and the sample patch after said rotating.

8. The method of claim 7, further comprising:

if the distance between the target patch and the sample patch is less than a threshold, saving the sample patch in a set of sample patches that can be used fill the target patch;

if said another distance between the target patch and the sample patch after said rotating is less than the threshold, saving said another sample patch in the set of sample patches that can be used fill the target patch; and

selecting one sample patch from the set of sample patches and filling the target patch with said one sample patch.

9. The method of claim 1, further comprising, prior to said selecting a target patch, said selecting a sample patch, said determining, said multiplying, and said summing:

converting the image from color to gray.

10. The method of claim 9, further comprising, after said converting the image from color to gray, said selecting a target patch, said selecting a sample patch, said determining, said multiplying, and said summing:

converting the filled image from gray to color.

11. The method of claim 1, further comprising:

if the distance between the target patch and the sample patch is less than a threshold, saving the sample patch in a set of sample patches that can be used fill the target patch;

selecting another sample patch and repeating said determining, said multiplying, and said summing for said another sample patch to determine another distance between the target patch and said another sample patch;

if said another distance between the target patch and said another sample patch is less than the threshold, saving said another sample patch in the set of sample patches that can be used fill the target patch; and

selecting one sample patch from the set of sample patches and filling the target patch with said one sample patch.

12. A method, comprising:

selecting a target patch to be filled in the image;

selecting a sample patch as a candidate for filling the target patch;

determining a first difference between a first area surrounding the target patch and a corresponding first area surrounding the sample patch, and a second difference between a second area surrounding the target patch and a corresponding second area surrounding the sample patch;

multiplying a larger of the first difference and the second difference with a first weight factor, and a smaller of the first difference and the second difference with a second weight factor;

summing the weighted first difference and the weighted second difference as a distance between the target patch and the sample patch;

if the distance between the target patch and the sample patch is less than a threshold, saving the sample patch in a set of sample patches that can be used fill the target patch;

selecting another sample patch and repeating said determining, said multiplying, and said summing for said another sample patch to determine another distance between the target patch and said another sample patch;

if said another distance between the target patch and said another sample patch is less than the threshold, saving said another sample patch in the set of sample patches that can be used fill the target patch;

selecting one sample patch from the set of sample patches and filling the target patch with said one sample patch;

adjusting pixel values of the selected sample patch to match the first and the second areas surrounding the target patch; and

filling the target patch with the adjusted sample patch.